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result. Here, again, the women are found to repeat one another more than the men.

(3) Regarding the time occupied in the process the result reached is that (roughly speaking) it takes on the average 308 seconds to write such a list of 100 words; that 210 seconds are consumed in the mere act of writing, 114 seconds in thinking of what to write, and 16 seconds in which both may be done.

These results are offered, in addition to whatever value they may possess, as an illustration of how, by simple experimental methods, we may become more intimate with the processes that we constantly but unconsciously perform.

ANTHROPOLOGY AND PREHISTORIC ARCHÆOLOGY.[1]

Anthropology of the American Association for the Advancement of Science, at Indianapolis.—The American Association for the Advancement of Science held its thirty-ninth meeting at Indianapolis, Indiana, beginning on Tuesday, August 19th, 1890, and continuing ten days. The meetings were held in the new State House, where were also the offices of the Local Committee and Permanent Secretary. This meeting was the fiftieth anniversary of the organization of the Association of Geologists and Naturalists, the parent of the A. A. A. S., which added greatly to its interest. Indianapolis, with its wide, well-shaded streets, its large, comfortable hotels, and the unusual accommodations afforded by which all the sections could meet in large halls under one roof, made this the most important meeting ever held in the West. The Local Committee are to be commended for their admirable arrangements for the comfort of the large number of members and their friends.

The department of Anthropology held its meetings in the Hall of Representatives, with Dr. Frank Baker, of Washington, D. C., as president, and Prof. Joseph Jastrow, of the University of Wisconsin, as secretary.

The address of the President of the Section was listened to with much attention, and created much interest. Dr. Baker is professor in the Medical College of the Georgetown University, lecturing on human anatomy, and is well qualified to speak as he did upon the "Ascent of Man." His arguments were in favor of the theory of

[1] This section is edited by Dr. Thomas Wilson, of the U. S. National Museum.

evolution of the species, and his facts were derived from the changes wrought in the anatomical structure of man. The theory was that those elements or peculiarities of the bones and muscles of man which by reason of his changed condition from brute to man, from quadruped to biped, were not used, have largely disappeared, and nothing is now found but the vestiges, while those which in the changed condition were more used grew and strengthened and became the new elements as we find them, but showing signs of their recent origin. He said, comparing the human hand with that of the anthropoids, its greater efficiency has been produced in two ways: first, increasing the mobility of the thumb and fingers; second, reducing the muscles used to assist prolonged grasps, they being no longer necessary. The latest elements ought to show signs of their recent origin, while those going out of use ought to have become vestigial. Of the former are the flexor muscles of the thumb and fingers; of the latter is the *palmaris longus*, used for climbing and grasping. These differences are more clearly manifested in the negro than in the white race. So also the change in the obliquity of the elbow-joint and the axis of the humerus, that the hand can be easier carried to the mouth. This is marked in the white race when compared with the negro, and still more when compared with the anthropoids.

The scapular index is highest in the white races, less in the infant, the negro, the Australians, and still less in anthropoids.

The *epitrachleo-anconeuo*, a small muscle at the elbow-joint, is used in apes to effect a lateral movement of the ulna upon the humerus, but in the white race this lateral motion has been lost, and the muscle has degenerated. A perforation of the olecranon fossa may be regarded as a reversion towards the anthropoids. The doctor continued these illustrations, citing the shoulder-blade, the foot, the great toe, the muscles needed for the erect position of man, the head, the spinal column, the pelvis, the bladder, the liver. The valves of the veins are arranged for a quadrupedal position. Evidently intended to resist the action of gravity, they should, to be effective, be found in the large vertical trunks. But in the most important of these they are wanting. Yet they occur in several horizontal trunks, where they are, as far as we know, of no use whatever. Place man on all fours, however, and it is seen that the entire system of valves is arranged with reference to the action of gravity in that position. The great vessels along the spine and the portal system, being then approximately horizontal, do not require valves; while all the vertical trunks of considerable size, even the intercostal and jugular veins, are provided with them. A confirmation of this view is found in the fact that the valves are variable in character, and tend to disappear in the veins where they are no longer needed. He concludes, upon surveying the whole field, that this indicates a derivation of the vertebrates from some form of the annelid worms, among which a single unit produces by successive budding a compound longitudinal body. This view is fully confirmed by the behavior of the human embryo. In the spinal column of the human embryo thirty-eight segments can at one time be made out. Four or five of these generally disappear, but cases are by no means wanting in which they remain until after birth, and constitute a well-marked free tail. In one case, carefully examined and described by Lissner, a girl of twelve years had an appendage of this character 12.5 centimetres long. Other observers, probably less careful and exact, report much greater lengths. From some observations it would appear that abnormities of this kind may be transmitted from parent to offspring. Dr. Max Bartels recently collected from widely-scattered literature reports of 116 actually observed and described cases of tailed men. In 35 instances authors report such abnormities to be possessed by an entire people, they themselves having observed certain individuals. These cases are scattered throughout the whole of the known globe, and extend back for a thousand years.

At first man's skull seems to be much simpler than the typical form. The bones are fewer and less complicated. But follow back the course of development, and we find the bones separating,—the frontal into two pieces, the occipital and temporal each into four, the sphenoid into eight, repeating what we find as we descend the vertebrate scale. The capacity of the cranium is usually held to distinguish man, yet the lowest microcephali approach to the apes in this respect, and the lower races have unquestionably smaller brains than the higher. As far as can be judged, there has also been an increase in average capacity during historic times.

"The Indian Origin of Maple Sugar," by Mr. Henry W. Henshaw, of Washington.—The point was as to whether the Indians learned to make sugar of the whites or vice versa. The argument drawn from the maple-tree festivals and linguistic evidence showed the red men were in no way indebted to the whites for sugar, no more than for the cultivation of corn, the pumpkin, bean, and tobacco. Their simple process was aboriginal, resulting from their own observation and inventive powers. They collect the sap in birch-bark vessels. These hold in some cases a hundred gallons. They take advantage of cold April nights to freeze the sap, and in the morning throw out the ice.

They evaporate it by throwing hot stones into the reservoirs of sap. The sugar is eaten mixed with corn. Sometimes the pure sugar is their only diet for a month. They boil venison and rabbits in the hot sap as they evaporate it. They also make sugar from the silver maple and box elder. That the Indians made sugar from times unknown is proved by their language, their festivals, and their traditions. Several authors of early times, telling af their visits to the Indians, mention maple sugar, and one of them, in 1756, describes the Indian's mode of preparing it. The gathering of sap and making of sugar formed one of their annual religious ceremonies.

"Fort Ancient, Ohio," by Mr. Warren K. Moorehead.—Mr. Moorehead spent two summers in excavating the mounds and studying the topography of Fort Ancient, on the Miami River. He has shown as much energy in digging out Fort Ancient as Schliemann in excavating Troy. As an indirect result of his labors, the Legislature of Ohio authorized the purchase of the fort and surrounding ground as a State park. A map of Fort Ancient, together with a short notice of Mr. Moorehead's work, was published in the American Naturalist, April, 1890, p. 383. His book on that subject, just published, which has already passed its second edition, gives a complete account of this great prehistoric earthwork.

The fort is really two, the old fort and the new fort, connected as by an isthmus. Each fort has about an acre and a-half of ground, and the two resemble in general shape North and South America, with their connecting isthmus. The cemeteries, from which over two hundred skeletons have been removed and measured, reveal two classes of people, two kinds of implements, and two varieties of pottery, plain and ornamental. The village seems to have been occupied for three periods, and each period of occupancy lasted for many years. Four feet below the present surface there are occasionally a bed of ashes or a mass of burnt rock, around which and in which occur large numbers of perforated mussel shells, bone awls, shells of the land tortoise, pottery fragments, flint chips, hammer stones, etc. Then there are about two feet of earth, which may have been deposited in a freshet, or slowly accumulated during a period of one hundred or more years that the ground was unoccupied. Following this is a second layer, heavier, while the third or upper stratum is but one foot from the present surface.

The preservation of minute bones, fragile shells, and perishable objects is due to the ashes, of which there were many bushels.

There is a spot in a field within a half a mile of the new fort, situated upon the plain where it commands a view of the enclosure, upon which were manufactured arrow-heads of quartz. Quartz is not frequent in Ohio, and we have never found it except in isolated specimens; its presence indicates that a distant tribe was present when these chippings were deposited.

On the village site in the old fort, and upon that near the Little Miami River, we found thousands and thousands of pottery fragments, some of them decorated in a similar manner to those at Madisonville. In the bottom of the ditches outside the fort, and in the fields bordering the fort upon the east side, we find a class of pottery sherds different from those found within the structure. I have upwards of five thousand specimens of pottery of both varieties. Years might be spent at Fort Ancient in excavation of the graves and cemeteries that nearly everywhere are to be found beneath the towering oaks and beeches, and yet there would remain sufficient material to engage the attention of archæologists for a long time to come. Questions all unsolved present themselves at every step. For instance, the age of Fort Ancient,—was it constructed all at one time or in epochs? The races of people who constructed it,—who and what were they? The civilization and social surroundings which required such a work, the terraces, the ravines, the timber in the walls, the gateways, the huts, the mounds, cemeteries, etc.

This great enclosure, so rich in facts, so productive of implements that tell us of the every-day life of the ancient people who lived within its walls, may yet reveal to the patient investigator its history, and dispel the darkness that surrounds the origin and movements of ancient men upon the American continent. It is to be hoped that every aboriginal structure in the United States will become the property of the Government, or of some institution which can preserve, explore, and beautify it.

Mr. W. H. Holmes, of the Bureau of Ethnology, Washington, D. C., read a paper on the "Aboriginal Stone Implements of the Potomac Valley." He has lately investigated the steatite quarries around Washington, and found the aboriginal vessels in their rudest stages of manufacture, also the implements with which they had been made.

He described his work among the quartzite bowlders on Piney Branch, near Washington. The impression of Mr. Holmes's paper, and the discussion following it, is thus told in one of the Indianapolis journals of the day:

"Hence the rude forms of chipped stones are not tools at all, as has been taught by archæologists for half a century, and so the 'rough stone age' and the 'smooth stone age' of the District of Columbia and all the rest of the world are knocked into smithereens. This is not Prof. Holmes's exact language, but that is just what he meant.

"Professor Holmes will pick a few bushels of flint bowlders out of Pogue's run, and by knocking one against the other can in a few hours leave evidences of the poor old 'Paleolithic man' scattered all over the capitol grounds. By finishing up his flint stones into good shape —arrow-heads, knives, skinners, etc.—he can prove that the Old Paleolith was followed by the Indian races. This knocks some dear old theories in the head, and particularly sets the French archæologists in the background.

"Professor Putnam, who knows all about it, observed exactly the same thing along the shores of Cape Cod several months before, and says the French have played the deuce with this ancient and honorable science, and that their 'effort to classify our ancestors on the form of their stone implements is no better than the matching of brass buttons.' 'Primitive man,' said Professor Putnam, 'made only a cutting-edge on the bowlders. The Indian went further and made knives and perforators, and that is all there is of it. The many divisions based on the shape of the implements is artificial and of no value.'

"Dr. Mason, the creator of the National Museum, did not like to see the 'French archæologists given such a black eye by Prof. Putnam,' but he placed a high value on the views of Mr. Holmes, which are accepted in this country almost universally. Mr. Holmes can make Indian arrows out of a beer-bottle, a piece of cannel coal, or anything that has a shell-like fracture. All he uses is a piece of hide to protect the hand, and a piece of deer antler or an iron nail to press off the flakes of flint. He can give pointers to Hiawatha's ancient arrow-maker, as he is not limited to jasper and chalcedony, but can shape them deftly out of almost anything except punk and dried pumpkin."

"The Brains of a Man and a Chimpanzee Compared," by Prof. Burt G. Wilder, of Cornell University.—Four large diagrams were displayed for the comparison. The fissures and contortions of the two brains were shown and commented upon, and the paper stated that the resemblances were numerous and impressive. "Indeed, if one were to look simply at the middle aspect of the two brains only, it would hardly be safe to affirm that one organism is the habitation of an immortal soul and the other one of the 'beasts that perish;' that the one was made only a little lower than the angels, and the other only a little higher than the monkeys."

Prof. Cope continued the comparison of the human brain and the chimpanzee's brain, being especially struck with the smoothness of the great convolutions in the brains of the lower types of men, in which they resemble the other mammalia. These, he said, are characters that cannot be remedied in any brief space of time,—perhaps cannot be remedied at all. These differences in the brain involve social and political questions.

"The brain structure we find in Indo-European races has required centuries to develop. We are now confronted in this country with the mixture of two races,—an inferior race which has never done anything with a superior race of later origin. The question is, Are we going to permit it? I believe we should follow the law of self-preservation, and should oppose and resist hybridization. We have before us a problem of race depreciation, and statesmen and reformers should study the question as Professor Wilder has studied it."

Dr. J. A. Houser, of Indianapolis, continued the discussion, saying that "the American people need have no fear of a race whose front brain lacks fifteen cubic inches of brain stuff as compared with the average. The superior cerebral convolutions of the brain have made the laws and governed the world. In all kindness and charity, the higher intellect should stoop down and say, 'I will help you, but you shall not control me.'"

The discussion continued into the next paper, which was by Mr. J. Muller: "The Peculiar Effects of One-Sided Occupations on the Anatamy and Physiology." Prof. Cope said: "The subdivisions of the higher races of men based upon the features of the face are of little value; in the lower races the divisions based on such peculiarities are more constant. Deep-seated anatomical characters are not easily altered by occupations; only superficial characters are so altered. A man with a flat shin bone is nearer the ape in relationship than a man with a triangular shin bone. A man with a tritubercular teeth is in that degree further from the ape. The shin bone, the tubercles, and the hyoid bone have characters which are not soon eradicated, and whose significance must not be forgotten. The tendency of the two last bones of the little toe to unite is a sign of advancement. The little toe is, in short, going out of existence. The man whose little toe-joints are anchylosed is a further remove from the ape. In the Hottentot, on the contrary, we have anchylosis of the bones of the nose, relating him to the lower primates. The science of paleontology comes in play here and gives us aid. These characters, like the flat shin bone and the smooth brow, are not easily overcome. They are deep-seated. We should exert ourselves to get rid of them, but not so fast as to depreciate the higher races."

The bearing of Prof. Cope's remarks was that important natural differences in races should have their weight in social life and politics.

Prof. Jastrow, of the University of Wisconsin, called attention to the distinction between characteristics relating to functions and activities during life and those observed upon the body after death. While the former may be very important and easily noticed in every-day life, the latter are those most in use by anthropologists for race distinctions. The former are modified in a relatively short period; the latter are relatively fixed, and are modified with extreme difficulty. The former are physiological, the latter anatomical; and it may be said that it takes a long time for physiology to be converted into anatomy.

Prof. O. T. Mason, of the Smithsonian Institution, read a paper on "The Arts of Modern Savages as a Means of Interpreting Archæology." He cited the walrus and other animals engraved on horn and ivory by the Esquimaux. A century ago they engraved with flint points; now they have steel knives, and their work is much superior to its former state. The art capacity of the people has not improved; the tool has improved. Such work must not be cited to a wrong purpose. By studying the work of present savage races under the varying conditions of contact with civilized races, much light may be thrown upon the development of races. "There is an apparent millennium among the archæologists here to-day," said Professor Mason; "we are holding an apparent love-feast, but we really represent two hostile camps. Some of us believe the tools found and the mounds and forts all over the great West were made by Indians. There are others here who believe these great works, built without the use of iron, were made by a people of another race,—the mound-builders, whom the Indians have followed. Much light may be thrown on this subject in the next five years. How shall we understand and interpret the tools, the dress, the habits, the houses, the laws, the social life, the religion, the folk-lore, of these ancient American peoples, whether they are Indians or mound-builders? That is for us to do, and the humblest may do their part. Collect all the facts, and the truth will at some time be interpreted."

Who were the Indians and the mound-builders? Has America been peopled by three different races,—mound-builders, Indians, and Caucasians,—driving off each other in succession? Or were the Indians and the mound-builders one and the same people? These are the questions which are considered by American archæologists of to-day.

Prof. Putnam, of Harvard, said regarding the "two hostile camps": "For my part, I do not regard either Indians or mound-builders as scientific names. The word Indian was a misnomer, as we all know,—an error not of the early navigators but of Columbus, who mistook the West Indies for the East Indies, and called the people Indians, a word now used for the aboriginal people of every country; even Australian Indians are spoken of. For my part, I believe the early inhabitants of America were of several stocks. I like the word 'stock' in this connection. There was a short and round-headed southwestern stock, as the Zuñis; there was a long-headed northwestern stock; also the Eskimo of the Arctic regions, and the Caribs of the West Indies. Of course these graded into each other and mixed, but the central types are distinct. These various peoples of the past comprised the so-called mound-builders and Indians. These are my views, and I do not stand entirely alone. The Harvard camp and the Washington camp have no other desire than to find the truth."

Prof. Putnam gave an elaborate description of his discovery of "A Singular Earthwork Near Foster's Station, in the Little Miami Valley," about twenty miles north of Cincinnati. Prof. Putnam was assisted by Dr. Hilborn, T. Cresson, Messrs. G. A. Dorsey, M. H. Seville, and Ernest Volk, all of the Peabody Museum. A series of drawings and photographs were used in illustration. Prof. Putnam had also several bushels of cinders, burnt limestone, charcoal, and ashes dug from the earthwork. "This mound," said the professor, "is in the angle of a creek and the river. It is a flat-topped, circular hill, about one-half mile round at the rim,—such a hill as is frequently found at the intersection of a creek and river. It is made by the river and creek washing away the drift material on either side. Such hills command the valleys as lookouts, and are often fortified. Around the brow of this hill is a ridge in some parts; at others it is not elevated above the surface. This ridge is made up of well-burnt clay, and includes masses of burnt limestone, clinkers, charred logs, and heaps of ashes, from a bushel to forty bushels in bulk. This strange circular rim is over half a mile long, twenty to fifty feet wide, and eight to ten feet deep. To have burnt all this clay must have required a heat like that of a Bessemer furnace. Another strange feature is that the rim of burnt stuff is backed by an escarpment of well-laid stone wall, to keep the burnt material in place. This stone wall probably extended down to the water, but the creek has worn its way down and away from the wall. We have cut through the burnt wall in several places, and shall penetrate it in others. No bones and but a few pieces of pottery have been found. The fires could not have been those of charcoal pits, nor was it a lime-kiln. There must have been an immense amount of fuel collected to burn this mass of clay and stone.'' The theory of cremation was discussed, but if these are crematories it is quite remarkable that no bones or remnants are found.

MICROSCOPY.[1]

Demonstration of the Chromosomes.[2]—In the preparation of the egg for tracing the history of the nuclear elements, Boveri employed two methods. In one, the preservative fluid was a mixture of picric and acetic acid, and the staining fluid borax-carmine; in the other, which was the principal reliance, Schneider's acid-carmine served both as a preservative and staining medium. The living egg is followed under the microscope until the desired stage is reached; then a drop of acid-carmine is added at one side of the cover-glass, and drawn under by the aid of a bit of filter-paper applied at the opposite side. After 5-30 minutes the fluid is replaced by glacial acetic acid, which decolorizes all parts of the egg except the chromosomes, and at the same time renders the cytoplasm quite clear, while giving a sharp definition to the chromatic elements. The achromatic elements are not well preserved.

The egg so prepared is mounted in glycerine. In order to determine the exact number of chromosomes it was often found necessary to press the egg more or less, and thus separate the chromosomes a little. These preparations last for only a few days.

Caryokinetic Figures.[3]—Dr. Solger calls attention to the fact that the amnion of the rat is more convenient material for exhibiting the caryokinetic figures than the mesentery of the young rabbit (recommended by Orth in his "Cursus der Normalen Histologie"). The advantage of such material is that it can be prepared without the necessity of imbedding and cutting.

The freshly-excised uterus horn is placed in *a saturated aqueous solution of picrid acid*, and then the egg-membranes—at least the chorion—is cut open with scissors. The amnion (of embryos 1.8 cm. long to 2 cm. long) then floats as a very thin membrane, or as a closed sac still envelops the embryo.

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[1] Edited by C. O. Whitman, Clark University, Worcester, Mass.

[2] Boveri. Jen. Zeitschr. XXIV., 2 and 3, 1890, p. 319.

[3] B. Solger. Arch. f. mik. Anat., XXXIII., 4, p. 517, 1889.